PROTECTING AMERICA

THE STATUS OF

RADIATION PROTECTION

IN THE US

PUTTING POLITICS OVER SCIENCE

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History

On April 26, 1986, an explosion occurred at the Soviet Chernobyl Nuclear Power Station in Ukraine, about 80 miles north of the city of Kiev on the border with Belarus. The resulting radioactive cloud contaminated an area half the size of Italy and exposed nearly 8,400,000 people in Belarus, Ukraine and Russia.[1] Millions of others, in Poland, Scandinavia, and throughout Western Europe were also affected.

Today, we continue to see the effects of the world's worst radiological emergency. Tens of thousands of people who were unable to take protective action have developed radiation induced thyroid damage, with estimates as high as 50,000 cases[2] of thyroid cancer expected by the year 2010. In 2000, the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) reported their findings that:

> *"It is 14 years since the accident, and yet the worst may still come…The number of people with thyroid cancer began to increase about five years after the accident. This number continues to rise…the number has exceeded expectations. Over 11,000 cases of thyroid cancer have already been reported."*[3]

These numbers came as no surprise to health-physicists at Sandia National Labs, working for the US Nuclear Regulatory Commission (NRC). Six years prior to the Chernobyl accident, Sandia issued a study of expected consequences of reactor accidents on the scale of Chernobyl, noting that *"cancer deaths and thyroid nodules could occur over…*[large] *distances (100's of miles)*" and predicting significant thyroid damage among people located as far as 200 miles downwind.[4]

Chernobyl was not the only time a radiation release had led to epidemic levels of thyroid disease. In a 2006 study among living Japanese atomic bomb survivors, researchers found that close to half (44.8%) suffered from some form of thyroid damage.[5] Even higher levels of thyroid disease occurred among residents of the Marshall Islands who were dusted with fallout following a 1954 weapons test, despite the fact that the test took place 180 miles away from the islands.[6] And in 1997, the US National Cancer Institute estimated that atomic testing in Nevada caused between 11,300 and 212,000 thyroid cancers among Americans in this country.[7]

These events demonstrated that radiation could cause thyroid damage over a **VERY** large area, and led to the realization that existing US nuclear industry practices to limit protective measures to just 10 miles around nuclear plants were clearly insufficient. Nowhere was this better illustrated than in Belarus, where 97% of the first 750 cases of thyroid cancer due to Chernobyl occurred among people located more than 30 miles downwind of the reactor.[8]

In fact, following a study that tracked the increased incidence of thyroid cancer caused by Chernobyl, the World Health Organization stated ***"The increase has been documented up to 500 km from the accident site."***[9]

But more unexpected was the finding that the cause of the cancer could be traced to just one type of radio-isotope known as radioactive iodine (RAI). Because RAI is absorbed by the thyroid, its presence led to the large increases in thyroid cancer and other thyroid diseases. Although Chernobyl also released other radioactive by-products, these had little or no significant effect on the public's health, with the NRC reporting the World Health Organization's conclusion that, 10 years after the accident:

> ***"except for thyroid cancer, there has been no confirmed increase in the rates of other cancers, including leukemia, among…the public that have been attributed to releases from the accident."***[10]

The Importance of Thyroid Protection

Thousands of cases of thyroid cancer have demonstrated that the most important step in a radiological emergency is protection of the thyroid from RAI—a step which can be assured by the prompt use of a safe, virtually 100% effective, thyroid-blocking, pharmaceutical—potassium iodide (KI). For maximum effectiveness, KI should be administrated as early as possible during the 60 day period when RAI is most dangerous. Thus, its early availability is crucial in the event of an emergency.

Unfortunately, thousands of children had to develop radiation-induced cancer before this lesson was learned. But, astonishingly, the NRC, while acknowledging that KI will protect those who receive it, continues to argue against the drug.

KI is not a new drug. Its ability to protect the thyroid from radiation has long been known and its use has been urged by groups such as the American Thyroid Association, who stated it is "*essential that enough KI be available to protect the public, especially children, in the event of a nuclear accident or radiological terrorism.*"[11] The American Academy of Pediatrics found that "*KI can be 100% effective in preventing radiation-induced effects, including thyroid cancer*…[which] *is the reason it should be kept in homes, schools, and day care centers,*"[12] and it is supported by the World Health Organization and numerous other groups. The U.S. FDA concurred, with the unequivocal statement that:

> "*The FDA recommends potassium iodide…for thyroid blocking in radiation emergencies*" and "*the data clearly demonstrate"* [that] *"KI can block thyroid uptake and thus provide safe and effective protection against thyroid cancer caused by irradiation"*[13]

So if the FDA has found KI to be safe and effective, and capable of protecting the public from thyroid damage due to radiation released by a weapon or power plant accident, why hasn't the government acted to assure we have it? Isn't that what homeland security is all about?

Congress Mandates Stockpiling of KI in 2002, But Fails To Follow Through

Actually, the government **has** acted. But despite an Act of Congress, the Bush Administration rejected recommended stockpiling efforts and kept the issue out of the public's eye.

Specifically, at the urgings of the country's leading endocrinologists, Section 127 of the Federal *Bioterrorism Preparedness and Response Act of 2002* directed President Bush to expand the program for stockpiling and distribution of KI tablets. To assure proper implementation of this directive, the President was authorized to request the National Academy of Sciences (NAS) to study the KI issue and to propose the most effective and safe way to distribute the tablets. Many hoped this would definitively resolve any question about potassium iodide, and assure its availability if ever needed.

The NAS report was completed and issued in December, 2004. Its comprehensive scientific review led to the following specific recommendations.[14]

> **Recommendation 1**: *"Potassium iodide (KI) should be available to everyone at risk of significant health consequences from accumulation of radioiodine in the thyroid in the event of a radiological incident."*
>
> **Recommendation 2**: *"KI distribution should be included in the planning for comprehensive radiological incident response programs for nuclear power plants. KI distribution programs should consider predistribution, local stockpiling outside the emergency planning zones (EPZ), and national stockpiles and distribution capacity."*

But despite these recommendations, little KI is available today. Rather than follow the NAS recommendations, the Bush White House and the nuclear power industry—fearing that KI sends an implicit message that nuclear power is unsafe—fought steps to assure the country has this protection. Unfortunately, the Obama Administration has continued this policy.

The Strange Arguments "Against" KI

Over the years, the arguments against KI have ranged from foolish to irresponsible. Initially, the industry claimed there was no need for KI because nuclear accidents were impossible—but the incident at Three Mile Island (and other near misses) refuted that contention. Then the industry claimed that KI would offer no more than a "false sense of security" in case of an accident, but was unable to provide either evidence or precedent for this claim. Next, questions were raised about the value and safety of KI, but these vanished in the face of the Chernobyl experience (where millions of people received the drug and were protected, and not a single serious side effect was seen among the general population). Then it was argued that KI had limited value since "it only protects the thyroid," but the rationale behind this argument disappeared as evidence mounted that thyroid protection was, by far, the most important step in dealing with a nuclear event. Failing here, the NRC finally agreed to distribute KI to anyone living within 10 miles of nuclear reactors. However, beyond 10 miles, protective measures would not include KI, and would be limited to programs emphasizing "evacuation"—even though the events in 2006 in New Orleans and Houston demonstrated the shortcomings of this strategy.

Their attitude was summed-up by the Director of the Illinois Department of Nuclear Safety, who saw no need for KI since "*hundreds of thousands of people live normal, healthy lives without functioning thyroid glands*"[15] and the statement of the Georgia official who preferred to depend on massive efforts to evacuate people, "*rather than trust them to be able to search through the backs of their medicine cabinets to find some magic pill that they're supposed to take to make it all better*."[16]

In 2005 a new argument was introduced as to why the country should avoid stockpiling KI tablets. Despite the National Academy of Sciences recommendations, a senior government official for Preparedness Programs for nuclear matters wrote to the Department of Health and Human Services arguing that rather than stockpile KI, "*other, more effective, protective measures are in place to protect the thyroid…and that expanded distribution of KI is unnecessary.*"[17] These "other*, more effective,* measures" he referred to were evacuation and quarantining all food and water from the contaminated areas in order to prevent ingestion of radioactive iodine.

But there is little confidence that this program could work. Evacuation of millions of people would effectively protect them, but is clearly infeasible. And while removing radioactive food would obviously prevent it from being eaten, the practical difficulties in intercepting all potentially contaminated food for thousands of square miles around a radiation release would be enormous. It would have to take place under the confusion that would accompany an accident or attack, be completed in a matter of days, and reach everyone from commercial food processing operations, to those who grow tomatoes in their back yards. Further, how to replace the food and water for the millions who do not evacuate has not been explained.

Worse, though, is that the NRC knows that merely blocking contaminated food and water is far from an effective solution. Their research on the dispersion and effects of radiation had previously led to findings that during the most dangerous stage of a release "*the thyroid dose* [of radiation] *is dominated by the inhalation of radioiodine*" and "*protective measure[s] must reduce the inhalation dose*."[18] Clearly, efforts to prevent ingestion of contaminated food (even if possible) would have no impact on inhalation, which is the major source of irradiation. Given these conclusions, it is difficult to understand how the nuclear industry could prefer a cumbersome, unworkable program to block food and water which, at best, would be only partially useful, as opposed to KI which is easy, simple, low cost and virtually 100% effective.

Yet, regardless of logic, facts, their own findings, the FDA, the experience at Chernobyl, and the conclusions of the NAS (and others), the NRC has continued to fight against wide KI distribution claiming mass evacuation and food control are better solutions. In March, 2006, their position was also rejected by Michael Leavitt, Secretary of Health and Human Services, who wrote *"we do not believe there are alternative and more effective measures* [than KI]."[19]

Failing to win this argument on its scientific merits, the NRC took a political approach. In 2007, the NRC requested the President to ignore all previous findings and instead appoint the Office of Science and Technology Policy (OSTP) to evaluate KI. They requested that the technical analysis of this issue come from the Federal Radiological Preparedness Coordinating Committee, a group of state regulators with close ties to the NRC whose anti-KI views were well known. Not surprisingly, the OSTP's January, 2008 carefully worded statement[20] ignored the science, and concluded that KI tablets "*offer negligible additional protection*" above evacuation and avoidance of contaminated food. Unfortunately, the OSTP did not consider the questionable feasibility of this strategy. Thus, the Administration announced that it would not follow the Congressional mandate to acquire KI under the *Bio-Terrorism Preparedness Act of 2002*.

Though the nuclear industry has long publicly stated that "safety is our first priority," their failure to assure an adequate supply of KI raises questions about their adherence to this position. Nowhere is this better demonstrated than in recent discussions regarding the radiation dose level at which individuals should take protective actions to protect against thyroid cancer and damage from RAI. Although experts at the International Commission on Radiological Protection established an intervention level of 1-2 rem, the NRC experts set the US level at 5 rem. This standard was used to support the decision to limit KI distribution to just 10 miles.

But, two NRC technical studies on the consequences of serious nuclear accidents make these disagreements between experts somewhat meaningless. **Both predict over 1000 rem** at 25 miles, **between 300 to 380** rem at 50 miles, and **70 to 100 rem** at 100 miles. Further, the experience of Chernobyl and the consequences of weapons tests leaves little doubt for the need for KI at significant distances downwind of any release of radioactive iodine.[3,4,5,6,8,9,21,22]

Anbex believes that the decision to put policy over protection is wrong, and that limiting KI distribution jeopardizes the public. We believe that in an environment where thoughtful concerns exist regarding nuclear safety, where major political figures have called nuclear terrorism the greatest threat to our security, where thyroid damage was identified as *"the primary internal radiation hazard during the first few weeks after atomic bomb fallout*"[21], where diagrams of US nuclear power plants were found in Al Qaeda camps in Afghanistan, where Osama bin Laden has boasted of his efforts to obtain a nuclear bomb and where the nuclear ambitions of Iran and North Korea cannot be contained, the importance of this matter should outweigh the nuclear industry's concerns that KI might be harmful to its image.

We further believe that the failure of the government to act in a sensible and responsible manner should be an issue for concern and debate. And we hope the efforts of individuals such as Congressman Ed Markey, who has introduced HR 6816, a bill that would expand KI distribution, will be recognized and supported, and that the public will demand that the Administration comply with the will of Congress to assure adequate supplies of this vital drug.

For additional information on KI, please refer to our web page at www.anbex.com, or to call us with questions at 727-784-3483

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REFERENCES

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1 United Nations, History of the United Nations and Chernobyl, set forth at http://www.un.org/ha/chernobyl/history.html.

2 http://www.ratical.org/radiation/Chernobyl/042600.html as reported by *The Guardian*

3 OCHA, *Chernobyl A Continuing Catastrophe*, United Nations, New York and Geneva, 2000

4 *Examination of the Use of Potassium Iodide (KI) as an Emergency Protective Measure for Nuclear Reactor Accidents*. Sandia National Labs. Prepared for US Nuclear Regulatory Commission, Oct., 1980, NUREG/CR-1433

5 *Radiation Dose-Response Relationships for Thyroid Nodules and Autoimmune Thyroid Diseases in Hiroshima and Nagasaki Atomic Bomb Survivors.* Journal of the American Medical Association, Vol. 295, No. 9, March 1, 2006

6 See *Radiation Effects in the Marshall Islands.* Clinical Endocrinology Branch, National Institutes of Health, Bethesda, MD; Medical Department, Brookhaven National Laboratory, Upton, NY, Jacob Robbins, Lead Researcher.

7 National Academy of Sciences. National Cancer Institute. Press Release. September 1, 1998

8 *Assessment of the Use of Potassium Iodide (KI) As a Public Protective Action During Severe Reactor Accidents.* U.S. Nuclear Regulatory Commission, Draft Report for Comment, NUREG-1633

9 *Guidelines for Iodine Prophylaxis following Nuclear Accidents*. World Health Organization, (1999 Update)

10 *Assessment of the Use of Potassium Iodide (KI) As a Public Protective Action During Severe Reactor Accidents.* U.S. Nuclear Regulatory Commission, Draft Report for Comment, NUREG-1633

11 February 13, 1998 letter to USNRC

12 American Academy of Pediatrics*, News Release,* May 19, 2003. Also, *Pediatrics Magazine,* June 2003

13 *Federal Register*, December 15, 1978, *FDA Talk Paper*, December 10, 2001

14 *Distribution of Potassium Iodide in a Nuclear Accident* National Research Council of the National Academies of Science, December 2004

15 Letter to US Nuclear Regulatory Commission dated January 8, 1998

16 *Got Anti-Nuke Pills? Probably Not* Randy Dotinga, Wired News, Nov. 8, 2004

17 Letter to Dr. Robert Claypool, US Dept. of Health and Human Services, November 1, 2005

18 *Examination of the Use of Potassium Iodide (KI) as an Emergency Protective Measure for Nuclear Reactor Accidents*. Sandia National Labs. Prepared for US Nuclear Regulatory Commission, Oct., 1980, NUREG/CR-1433

19 *Letter from Michael Leavitt to USNRC,* March, 27, 2006

20 *U.S. Scraps Plan for Anti-Radiation Pills* , USA Today, January 29, 2008. See also: *Decision Memorandum,* Executive Office of the President, Office of Science and Technology Policy, January 22, 2008, John Marburger, Director.

21 U.S. Nuclear Regulatory Commission, *.An Analysis of Potassium Iodide (KI) Prophylaxis for the General Public in the Event of a Nuclear Accident.* Released as NUREG/CR-6310, Prepared by S. Cohen & Associates for the NRC Office of Nuclear Regulatory Research, April, 1992

22 National Council on Radiation Protection (NCRP), Report No. 42 *"Radiological Factors Affecting Decision-Making in a Nuclear Attack"*, November 1974.

TWO HUNDRED MILE ZONES AROUND US NUCLEAR PLANTS

(Reactor Location Source: US Nuclear Regulatory Commission)

U.S. NUCLEAR REGULATORY COMMISSION

Examination of the Use of Potassium Iodide (KI) as an Emergency Protective Measure for Nuclear Reactor Accidents.

NUREG/CR-1433
Sandia National Laboratories, October, 1980

EFFECTS OF CORE-MELT ATMOSPHERIC ACCIDENTS BY DISTANCE

Distance From Reactor In Miles	Mean Thyroid Dose (REM) for Exposed Adult Outdoors	Probability of Thyroid Damage to Exposed Adult Located Outdoors
1	13,800	60%
5	6,800	70%
10	3,200	70%
25	1,100	40%
50	380	13%
100	100	3%
150	36	1%
200	16	.5%

Data taken from Tables 3 and 4 with following clarifying notes:
--For children, increase dose and probability of damage by an approximate factor of two
--Includes inhalation dose only. Does not include effects of ingestion of contaminated food or water
--Thyroid damage includes benign pre-cancerous and cancerous thyroid nodules and ablated thyroids.
--Table constructed assuming typical weather conditions

U.S. NUCLEAR REGULATORY COMMISSION

*An Analysis of Potassium Iodide (KI) Prophylaxis for the General Public in the Event of a Nuclear Accident**

Plume Center-Line Thyroid Doses (rem) for RSUR-1 Accident
S. Cohen & Associates, April, 1992. NUREG/CR-6310

Distance Range (MI)	Infant	Child	Teenager	Adult	Average Person
1-5	20,000	38,000	24,000	9,550	20,000
5-10	7,400	14,500	8,950	3,600	7,300
10-25	1,800	3,450	2,150	865	1,800
25-50	300	575	365	145	300
50-100	69	135	85	34	70
100-150	31	62	39	16	32
150-200	19	38	24	9	19
200-350	8	17	11	4	9

Thyroid dose includes all radionuclides and pathways. Doses assume typical weather conditions.
Data excerpted from Table 4-8

Expected Thyroid Damage Without KI for RSUR-1 Accident

DISTANCE INTERVAL (Miles)	EXPECTED THYROID DAMAGE (Damage Includes Thyroid Cancers, Thyroid Nodules, and Hypothyroidism)
1 - 5	603
5 - 10	1,190
10 - 25	1,701
25 - 50	1,271
50 - 100	826
100 -150	612
150 - 200	481
200 – 350	899
350 – 500	1,411
Cumulative Expected Damage	8,994

*Prepared under NRC Contract No. NRC-04-90-070, for U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research.
Note: “Expected Damage” based on an area with average population density. Any actual event could have significantly different consequences.
Data excerpted from Table 4-16